

REMARKS

Applicant has noted that the reference numeral "46" is used in the application specification and drawings as originally filed to refer to two different elements. By the foregoing amendment of paragraphs [0029], [0030], and [0031] of the application specification, Applicant has amended the specification to change reference numeral "46", referring to "remaining photoresist", to reference numeral "51". Drawing figures 8 and 9 are amended, as shown in the Appendix attached hereto, to correspond to this amendment of the application specification text. It is respectfully submitted that this Amendment of the specification and drawings does not add any new matter thereto. Therefore, it is respectfully requested that this amendment of the specification and claims be entered.

In the Office Action of March 10, 2006, Claims 1, 2, 6, 9, 10, 16 and 17-19 were rejected under 35 U.S.C. § 102(b) as being anticipated by the paper by Spector et al., Technique for rapid at-wavelength inspection of extreme ultraviolet mask blanks. Claims 3-5, 11, 12, 15 and 20-23 were rejected under 35 U.S.C. § 103(a) as being unpatentably obvious over Spector et al., in view of U.S. Patent No. 6,335,531 to Somerville et al. Claims 7, 8, 13 and 14 were objected to as being dependent upon a rejected base claim, but were indicated allowable if rewritten in the proper form.

By the foregoing amendment of the Claims, pending claims 22 and 23 have been canceled without prejudice to the patentability thereof. It is respectfully submitted that remaining claims 1-21, as currently pending, are not anticipated by, or unpatentably obvious over, the cited references, considered separately or in combination, and are, therefore, in a condition for allowance, for the reasons presented below.

It is first respectfully noted that a claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. Also, the identical invention must be shown in as complete detail in the cited reference as is contained in the claim. (See MPEP 2131.) Furthermore, to establish a *prima facie* case of obviousness under 35 U.S.C. § 103(a) there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings, there must be a reasonable expectation of success, and the prior art references when combined must teach or suggest all the claim limitations. (See MPEP 2143.)

Claim 1 of the present application is drawn to a method for detecting defects in a lithography mask blank. Claim 1 features the steps of: (a) applying a photoresist layer directly onto a reflective surface of the mask blank, (b) exposing the photoresist layer with radiation having a wave length and angle of incidence such that the photoresist layer is fully exposed by the combination of direct radiation and reflected radiation from the mask blank in areas of the mask blank in which there are not defects, (c) developing the exposed photoresist layer to remove the fully exposed photoresist from the mask blank, and (d) detecting photoresist remaining on the mask blank after development of the photoresist layer to detect defects in the mask blank.

Thus, in accordance with the method of Claim 1, the photoresist layer on a mask blank is exposed fully in areas of the mask blank in which there are not defects, and developed to remove the fully exposed photoresist such that photoresist remains on the mask blank only in areas of the mask blank that correspond to defects therein. Thus, the method of Claim 1 may employ a "dark field" imaging technique by which only defects appear in the field of view of inspection. By this method a signal only appears if, and where, a defect is found on the mask blank being inspected. In other words, the presence of a defect, indicated by remaining photoresist, "pops out" upon inspection of the mask blank after development, in contrast to the "dark" background of the defect free portions of the mask blank, in which no photoresist remains. Thus, this method for detecting defects is extremely effective, efficient, and sensitive. Very small defects can be detected in this manner. (See e.g., paragraphs [0010], and [0012] of the application specification as originally filed) It is respectfully submitted that the mask blank inspection method described in Spector et al. is both different from the method as featured in Claim 1, and that the method for detecting defects as featured in Claim 1 overcomes limitations of the inspection method taught in Spector et al.

Spector et al. describes an EUV mask inspection technique in which defects are marked by a brief flood exposure to EUV radiation and then examined optically. In the simplest arrangement of the inspection technique described, illustrated in Fig. 1 of Spector et al., a thin layer of EUV sensitive resist is applied directly to the multilayer-coated mask blank which is then flood exposed with EUV radiation. During the flood exposure, incoming EUV radiation passes through the thin layer of resist, reflects off the multilayer coating, and then passes back through the resist once again. A local decreases in the blank's reflectivity will reduce the exposure to the resist above defects sites. After exposure, partial development of the resist will show reflectance defects as mounds (pits) in a positive (negative) tone resist.

The mounds can then be detected by visual inspection, such as using an optical microscope. (See page 3003, right-hand column, of Spector et al.)

Thus, it is respectfully submitted that Spector et al. does not describe or suggest detecting defects in a mask blank by fully exposing a photoresist layer applied to the mask blank in areas of the mask blank in which there are no defects, and then developing the exposed photoresist layer to remove the fully exposed photoresist such that defects in the mask blank may be detected by detecting merely the presence or absence of remaining photoresist on the mask blank. Rather, Spector et al. describes and suggests partial exposure and development of the resist such that the mask blank under inspection remains covered with a resist layer. Defects in the mask blank are thus not detected by detecting the presence or absence of remaining photoresist, but by inspecting the remaining photoresist layer for mounds (or pits) therein. Thus, Spector et al. does not describe or suggest the dark field imaging for mask defect inspection made possible by the method of Claim 1. The result is that it is much easier to detect defects in the mask blank using the method of Claim 1, and very small defects may be detected. Spector et al. admits the sensitivity limitation of the method described therein: "As features become smaller, they will be visible until they blend into the background, or reach a size below the detection limits of the optical instrument." (Spector et al., page 3007, top of right-hand column.) This limitation of the method described in Spector et al. is not a limitation of the method for detecting defects as featured in Claim 1, because rather than looking for mounds (or pits) of photoresist in a background of photoresist, in accordance with the method of Claim 1 the entire "background" of photoresist is removed in areas of the mask blank in which there are no defects, such that only the presence or absence of photoresist on the mask blank need be detected to detect the presence of defects therein. In this case, resolution is not an issue, since, particularly where fluorescence is used to detect photoresist remaining on the mask blank, single molecules of remaining photoresist may be detected. (See e.g., paragraph [0030] of the application specification.)

Therefore, since Spector et al. does not describe or suggest a method for detecting defects in a lithography mask blank in which a photoresist layer applied to the mask blank is fully exposed by direct and reflective radiation, and the exposed photoresist layer is developed to remove the fully exposed photoresist from the mask blank, leaving photoresist remaining on the mask blank only in areas corresponding to defects therein, as featured in Claim 1, it is respectfully submitted that Claim 1 is not anticipated by, or unpatentably obvious over, Spector et al. Claims 2-10 depend, directly or indirectly, from independent

Claim 1, and incorporate the features thereof. Therefore, it is respectfully submitted that dependent Claims 2-10 also are not anticipated by, or unpatentably obvious over, Spector et al. and are, therefore, also in condition for allowance.

Independent claims 11 and 16 as currently pending in the present application also are drawn to a method for detecting defects in a lithography mask blank or other reflective material in which a photoresist layer applied onto a reflective surface is exposed fully in areas thereof in which there are not defects and wherein the exposed photoresist layer is developed to remove the fully exposed resist from the reflective material such that photoresist remaining after development may be detected to detect defects in the mask blank/reflective material. As discussed above, with reference to independent Claim 1, it is respectfully submitted that these features of independent Claims 1 and 16 are not described or suggested by Spector et al. Therefore, it is respectfully submitted that independent Claims 11 and 16 also are not anticipated by, or unpatentably obvious over, Spector et al. for the reasons discussed above with reference to independent Claim 1, and are, therefore, also in condition for allowance. Dependent Claims 12-15 and 17-21 depend, either directly or indirectly, from Claims 11 and 16, respectively, and incorporate the features thereof. Thus, it is respectfully submitted that these dependent claims 12-15 and 17-21 also are not anticipated by, or unpatentably obvious over, Spector et al. and are also in condition for allowance, for the reasons discussed above.

Claims 3-5, 11, 12, 15 and 20-23, as pending in the present application, incorporate the additional feature of including a fluorescent material incorporated in the photoresist layer applied to the mask blank or other reflective surface which is then fully exposed in areas thereof in which there are no defects and developed to detect defects in the underlying material. As noted in the Office Action, Spector et al. does not discuss the use of fluorescent materials in the resist to assist in the observation process. Sommerville et al. teaches modifying a resist with a fluorescent material to enhance the detectability of resist that inadvertently remains on a surface upon which an integrated circuit is fabricated. It is respectfully submitted that nothing in Sommerville et al. suggests the use of the modified resist described therein for the detection of defects in a mask blank or other reflective surface as featured in the claims of the present Application, or the use thereof in the inspection technique taught in the Spector et al. It is respectfully submitted, in fact, that the use of a resist modified with a fluorescent material in the technique described in Spector et al. would not improve defect detection using such a technique. As discussed above, Spector et al. teaches detecting defects as mounds or pits in a layer of photoresist that remains covering the entire surface being inspected. It is respectfully submitted that incorporating a fluorescent

material in the photoresist layer would not improve the detectability of mounds or pits therein. Since, in Spector et al., a layer of photoresist remains across the entire surface after development, illumination of the surface to excite a fluorescent material in the photoresist would cause the entire surface to fluorescence. This may, in fact, make it more difficult to detect the presence of mounds or pits therein. Thus, it is respectfully submitted that there is no incentive to combine the teachings of Spector et al. and Sommerville et al., in that the combination of such teachings does not improve the performance of the technique described in Spector et al. Furthermore, and in any case, as discussed above, such a combination, even if made, does not describe or suggest the elements of the Claims of the present application. Therefore, it is respectfully submitted that Claims 3-5, 11, 12, 15 and 20-23 are also not anticipated by, or unpatentably obvious over, the cited references, considered separately, or in combination, for the additional reasons just discussed.

For the foregoing reasons, it is respectfully submitted that all of the Claims 1-21 meaning pending the above-referenced patent application after entry of the foregoing amendment are not anticipated by, or unpatentably obvious over, either of the cited references, considered separately, or in combination, and are, therefore, in condition for allowance. Favorable action on the present application is, therefore, respectfully submitted.

Respectfully submitted,



Peter J. Manghera
Reg. No. 40,080

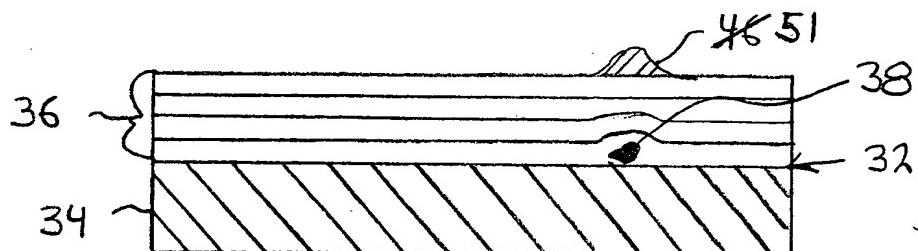
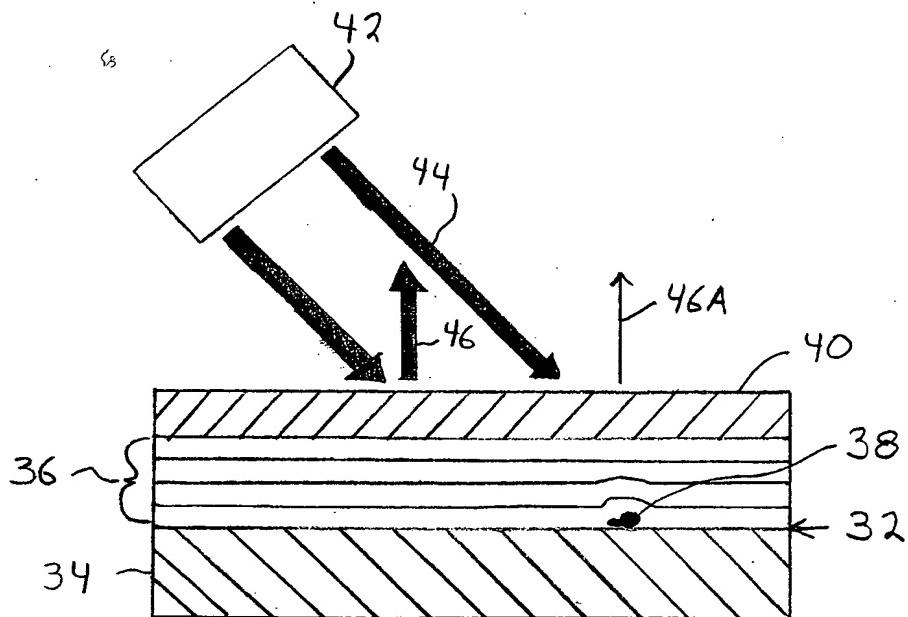
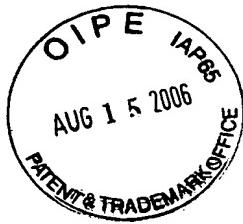
Reinhart Boerner Van Deuren s.c.
22 East Mifflin Street
Madison, WI 53703
608-229-2200
Client No.: 068408-0007
Customer No.: 22922

Attachments
Madison\167701

APPENDIX

Amended Drawing Figures

Appl. No. 10/616,863
Amdt. Dated Aug. 10, 2006
Reply to Office Action of Mar 10, 2006
Marked-Up Drawing Showing Changes





Appl. No. 10/616,863
Amtd. Dated Aug. 10, 2006
Reply to Office Action of Mar 10, 2006
Marked-Up Drawing Showing Changes

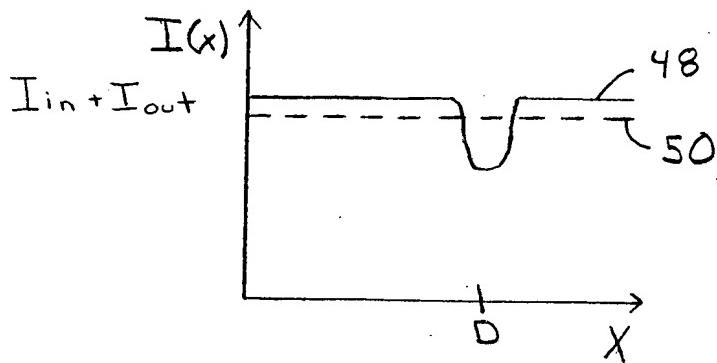


Fig. 7

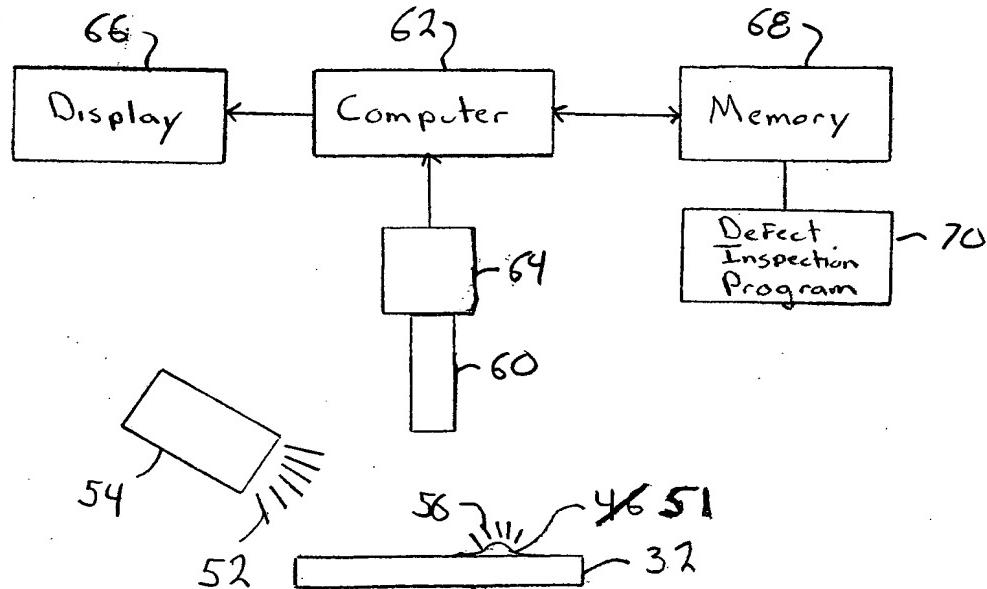


Fig. 9